PROJECT MANAGEMENT

PERT | CPM

FOR

Management Science
(Operations Management)
&
Production & Operations Management

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29/05/2020

Jamshedpur

29/05/2020

Project Management

PERT / CPM

A Project is a unique, one time set of activities that is intented to achieve an objective in a given time period. The project is some length (Weeks, Months, years) and uses resources (human, Capital, Materials and Equipment).

Project Managent technique(s) are useful when a project Consists of Several activities, Some Simultaneous and other Sequential.

Project Management Can be used to manage Complex projects.

The size, length, and scope of projects vary widely according to the nature and purpose of the Project. They go through a life cycle called PROJECT LIFE CYCLE, which typically Consists of five phase.

(1) Initiating (2) Planning (3) Executing,
(4) Monitoring and Controlling, (5) closing

Key Decision(s) in Project Management.

- Deciding which projects to implement
- Selecting the Project Manager
- Selecting the Project Team
- Planning and designing the Project
- Managing and Controlling project resources
- Deciding if/ when the project should be terminated.

The Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are two popular quantitative analysis techniques that help managers plan, schedule, monitor, and Control large and Complex projects.
By using PERT / CPM, Managers are able to obtain

1) A graphical display of Project Activities
2) An Estimate of how long the project,

3) An indication of which activities are the most critical to timely project completion.

4) An indication of how long any activity can be delayed without delaying the project.

Backgrounder — PERT was originally developed to plan and monitor the Polaris missile in 1950 (US Navy) & CPM was developed by Dupont De Nemours Inc. (1957)

PERT : Program Evaluation and Review Technique is Network planning technique used to determine a projects planned completion date and identify the projects critical path.

CPM : Critical Path Method is Network Planning technique, with deterministic times, used to determine a project's Planned Completion date and identify the project's Critical Path.

Steps of PERT / CPM

1) Define the Project and all of its significant activities or / tasks.
2) Develop the relationships among the activities
3) Draw the Network Connecting all the activities
4) Assign time and / or Cost estimates to each activity.
5) Compute the longest time path through network, this is called Critical path.
6) Use the network to help plan, schedule, monitor, and Control the Project.

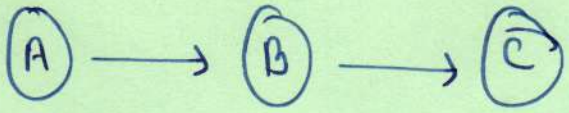
PERT / CPM Network

There are two common techniques for drawing PERT network;

(1) Activity - on - node (AON)
(2) Activity - on - arrow (AOA)

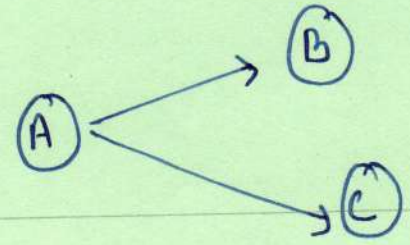
The Activity - on - nodes (AON) diagram represents Project activities by nodes and precedence relationships by arrows.

(1)



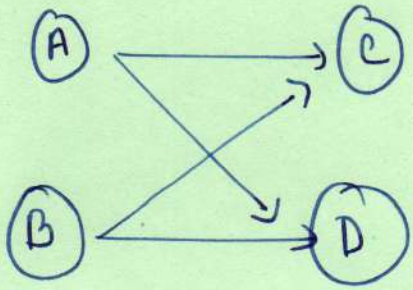
Activity A precedes activity B, which precedes activity C

(11)



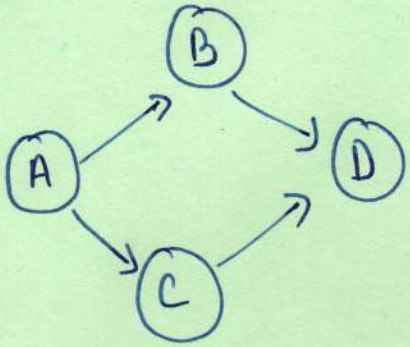
Activity A must be Completed before activity (ies) B & C Can begein.

(III)



Activities A and B must both be Completed before activity C or D can begin.

(IV)

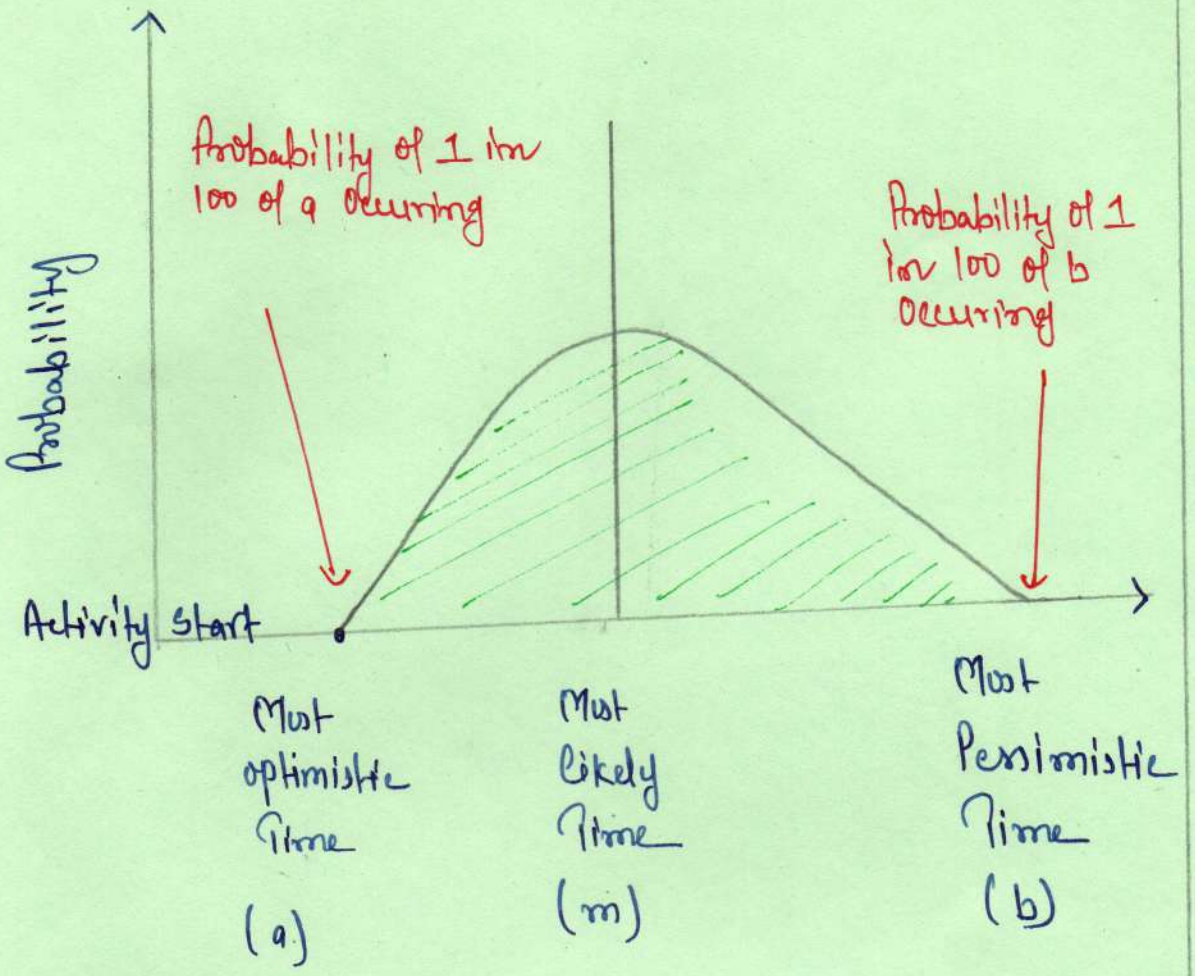


Activities B and C can begin once activity A has been Completed; Activity D Cannot begin until both B and C are Completed.

Activity Times

The next step in both CPM and PERT is to assign estimates of the time required to complete each activity. With Probabilistic Time Estimates, we make three time estimate

i) Most optimistic Time (a)
ii) Most likely Time (m)
iii) Most pessimistic Time (b)



Beta Probability Distribution# with Three Time Estimates

Typically represent project activities.

Optimistic time (a): The shortest time Period in which the activity can be Completed.

Most likely Time (m): The normal time that the activity is expected to take.

Pessimistic Time (b): The longest time period in which the activity will be Completed.

To find the Expected Activity Time (t), the beta distribution weights the estimates as

$$t = \frac{a + 4m + b}{6} \quad \text{—(1)}$$

To Compute the dispersion or; Variance of Activity Completion time;

$$\text{Variance} = \left(\frac{b - a}{6}\right)^2 \quad \text{—(2)}$$

Critical Path

To find Critical Path, we need to determine the following quantities for each activity in the network.

(1) Earliest start time (ES)

The earliest time an activity can begin without violation of immediate predecessor requirements.

(2) Earliest Finish Time (EF)

The earliest time at which an activity can end.

(3) Latest start Time (LS)

The latest time an activity can end without delaying the entire Project.

(4) latest finish time (LF)

The latest time an activity can end without delaying the entire project.

In the network, we represent these times as well as the activity times (t) in the nodes as given

Activity	t
ES	EF
LS	LF

Earliest start = largest of the earliest finish times of immediate predecessor

ES = Largest EF of immediate predecessors.

Earliest Finish Time = Earliest start time + Expected activity time

$$EF = ES + t$$

The Start of the whole Project will be set at time Zero. Therefore, any activity that has no predecessor will have an Earliest start time of Zero. So ES = 0 for both A and B in the General.

Latest Time (start) = Latest finish time − Activity time

$$LS = LF - t$$

Latest finish time = Smallest of latest start times for following activities or;

LF = Smallest LS of following activities

Probability of Project Completion

PERT Uses the Variance of Critical Path activity (ies) to help determine the Variance of the overall Project. If the activity times are statistically independent, the project Variance is Computed by Summing the Variance of the Critical Activities:

Project Variance =

$\sum$ Variance of Activities on the Critical path.

Variance by Squaring the Standard deviation by;

$$\sigma^2 = \left[\frac{t_p - t_o}{6}\right]^2 \text{ or; } \frac{(t_p - t_o)^2}{36}$$

Advantages PERT

Planning for large Project
Visibility of Critical Path
Analysis of Activity
Coordination Ability
The what if Analysis

CPM

Provides an outline for long term Coordination and Planning of a project.
Recognize Critical activities
Easy to plan, schedule and Control Project
It improves Productivity

29/05/2020